3. JADS EW SPJ Test Approach

The previous section described the entire multiphased test program which includes the SPJ test, and the leveraged ADEWS proof-of-principle demonstration. This section will focus on the primary activity of the test program, the SPJ test.

3.1 PHASE I: EW DEVELOPMENTAL T&E METHODOLOGY

The purpose of the SPJ test is to determine the utility of ADS technology by applying it to various phases of the EW process. The test methodology is designed to provide a baseline of performance data in a non-ADS test environment which is then compared to multiple tests of a configuration of the SPJ in an ADS environment.

Baseline data for the SPJ tests will be developed by establishing a threat environment on an OAR, flying multiple flight profiles through the environment, and measuring the performance of the SPJ for each engagement. This is the first test in Phase 1, the validation test. The threat environment is currently planned to include six command-guided surface-to-air missile sites, one semi-active surface-to-air missile site, and one anti-aircraft artillery site.

The flight profile data and threat environment data from the validation test on the OAR will be combined to replicate the OAR test environment in a synthetic environment consisting of a network of test facilities using the same profiles and threat laydowns. Conceptually, the various functions of the test can be located in different facilities, as pictured in Figure 3-1, or some of the functions could be co-located.

The second test in Phase 1 will use a DSM of the selected SPJ with ADS and will emulate a test of a developmental system early in the acquisition cycle. The third test will use a brassboard configuration of a SPJ on an EW "hot bench" to evaluate ADS utility for T&E in a SIL. The SUT will be linked to terminal threats located at the HITL and OAR. The fourth test will use an SPJ installed on the actual aircraft. The aircraft and jammer will be located in an ISTF. This test emulates a test of an EW system late in the acquisition cycle. The measured data from the validation test on the OAR, the DSM test, the HITL test, and the ISTF test will be analyzed for variability and correlation. Additionally, the test results will be analyzed to identify and assess ADS-induced errors.
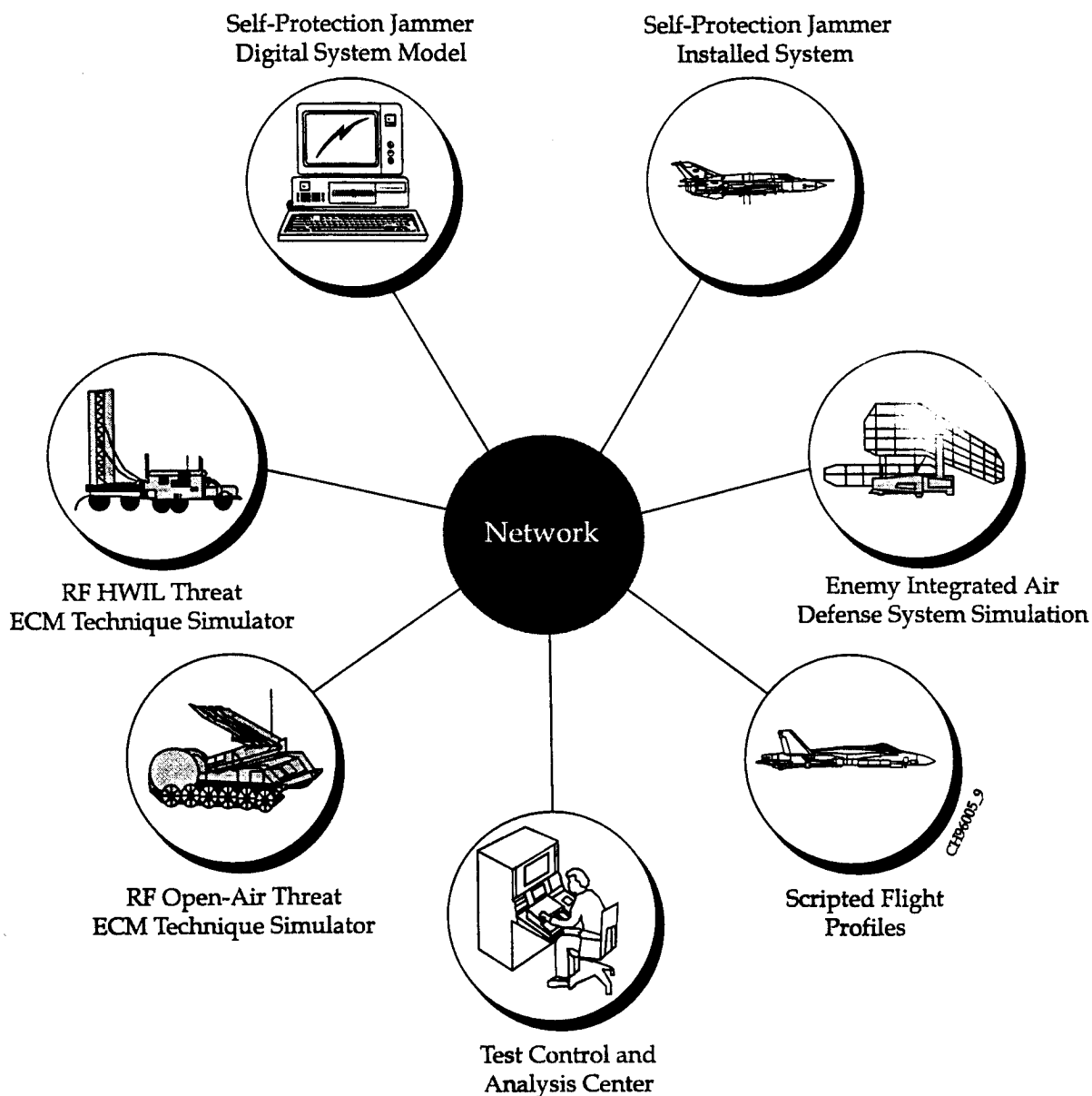
Figure 3-1. Conceptual ADS EW Test Environment

Labels in figure:
- Self-Protection Jammer Digital System Model
- Self-Protection Jammer Installed System
- RF HWIL Threat ECM Technique Simulator
- Network
- Enemy Integrated Air Defense System Simulation
- RF Open-Air Threat ECM Technique Simulator
- Scripted Flight Profiles
- Test Control and Analysis Center

3.2 PHASE I: TEST ENVIRONMENT

The modern EW environment consists of threats and countermeasures in the RF, infrared, and electro-optical spectrums. The most sophisticated test environment for EW is the RF environment and has been selected for this test. The primary reasons for selecting this environment include: (1) wide experience with RF protection jamming dating to the 1950s; (2) current IADS based on radars operating in the RF spectrum; (3) majority of current threats utilize

radars for target tracking and for missile guidance; and (4) the RF environment presents the widest range of test assets and facilities.

Each test will require an appropriate configuration of a SPJ as the SUT. The validation test on an OAR will require an instrumented SPJ on an actual aircraft. The DSM test will require a SPJ digital model and the ability to simulate the RF outputs of the SPJ. The HITL test will require a SPJ in a brassboard configuration operating on an EW "hotbench" and the ability to simulate the RF outputs of the SPJ. The ISTF test will again require an instrumented SPJ and an instrumented aircraft.

The aircraft selected for the test will already be using the selected SPJ operationally. A live aircraft will be used during the validation test on an OAR and time-space-position information (TSPI) from the flights will be used to develop the scripted flight profiles for the three ADS tests in Phase 1 (i.e., the DSM, HITL, and ISTF tests).

Threat environments of today link early warning radars, ground control intercept radars, and terminal threats along with command and control facilities into an IADS. An IADS will be a key component of each of the test environments. The system will be depicted using range assets for the validation test on an OAR and may be simulated using either human-/hardware-in-the-loop facilities or a digital model of the system for the ADS tests. While the actual configuration of the IADS will be driven by the OAR assets, it is desired that the hierarchy and timing of the system represent one of the typical threat air defense environments.

The desired terminal threat environment will be represented by both OAR threats and HITL threats. For the validation test on an OAR, range assets representing actual threat systems will be used in conjunction with missile flyout models to conduct engagements against the SPJ on the aircraft. For the ADS tests, the threats will be represented by virtual threats in HITL facilities and an OAR asset will be included as a linked threat for the ADS tests.

3.3 PHASE I: TEST ARTICLES

The ADS EW test environment discussed in section 2.2 and the previous section identified multiple choices in varying fidelity for the various components of the environment. A key requirement for the test designer in an ADS environment is to tailor the environment based on the maturity of the system, the test objectives, and program constraints. We have applied similar criteria to the selection of components for this test.

3.3.1 EW SUT

We selected the ALQ-131 Block II with reprogrammable processor as the SUT. Key to its selection was the availability of a DSM. During the development of the ALQ-131 Block II R/P, Georgia Tech Research Institute (GTRI) developed a digital model of the system which simulates all hardware and processing and will run the operational flight program of the SPJ. The model was upgraded throughout the development cycle and was used for ground and flight test rehearsals. The model will require some additional upgrading to the current operational configuration. It will also have to be modified to support real-time networked performance. The original software, documentation, and development team is available for this upgrade. This RF SPJ is currently fielded in a pod configuration and is used on several Air Force aircraft. The system performance is well understood by the community and it provides a relatively sophisticated jamming capability. Test assets are readily available, easy to support, and the reprogrammable processor allows it to be easily configured for the planned test.

3.3.2 Host Aircraft

Along with compatibility with the system under test, we required the selected host aircraft to be a non-developmental penetrator. The aircraft needed to be readily available and capable of being easily supported and instrumented for the tests. The logical choice was the F-16C.

3.3.3 Integrated Air Defense System (IADS)

A depiction of the enemy IADS can be provided at several levels of fidelity. Each of these levels are suitable for the SPJ test and we will use the highest fidelity IADS available.

REDCAP & TSMO: The first choice for the IADS has the advantage of splitting the early warning function from the missile battalion command and control function. The Air Force's REDCAP facility in Buffalo, NY, provides both hardware- and human-in-the-loop capabilities to simulate the early warning and intercept radars and the command and control centers associated with those functions. The Army's TSMO at Redstone Arsenal, AL, has the capability to simulate the command and control functions of a missile battalion. Linking the two of these facilities with terminal threats provide the highest fidelity capability for the test.

Alternative options for representing the enemy IADS are:

(1) REDCAP alone: The REDCAP facility alone, our second choice, also has the capability to simulate the missile battalion command and control functions in addition to its other capabilities.

(2) ACETEF: The Navy's ACETEF can simulate the command and control environment suitable to run the test scenarios and collect adequate test data. ACETEF has the advantage of

considerable experience in linking facilities and is currently leading the HLA engineering prototype federation.

(3) AFIWC: Another choice is the Air Force Information Warfare Center (AFIWC). The center, in conjunction with the Joint Command and Control Warfare Center (JCCWC) is developing an operationally representative model of current IADS. This model also appears to be suitable for the test.

These options will be evaluated during the test planning phase and a choice made based on capability, availability, and cost if our first choice is unavailable.

3.3.4 EW Terminal Threats

The primary facility in any of the Services for simulating terminal threats is the AFEWES facility at Ft Worth, TX. The facility provides a wide variety of terminal threats and has considerable linking experience. The facility has a sophisticated electronic countermeasures (ECM) technique generation capability and an environment generator which will combine multiple threats. The models are currently validated and are used extensively for EW testing. We plan to simulate five different threats using this facility. The Navy's Electronic Combat Simulation and Evaluation Lab (ECSEL) at Point Mugu Naval Air Station, CA, and the ACETEF at Patuxent River, MD, are the sources for additional HITL threat simulations. The addition of these facilities using ADS will evaluate the ability to increase threat resources using multiple facilities.

A key capability for EW testing in an ADS environment is to add the fidelity of an OAR threat. This capability requires the ability to inject target, ECM, and clutter information into the threat radar in real-time. The only current capability is synthetic target generation. The development of this capability adds cost and risk to the JADS EW test, but, we will initiate the development of a prototype of this capability for inclusion in the Phase 1 tests using ADS.

3.3.5 Test Article Summary

The figure below illustrates the potential test articles and their representations in the proposed SPJ test.
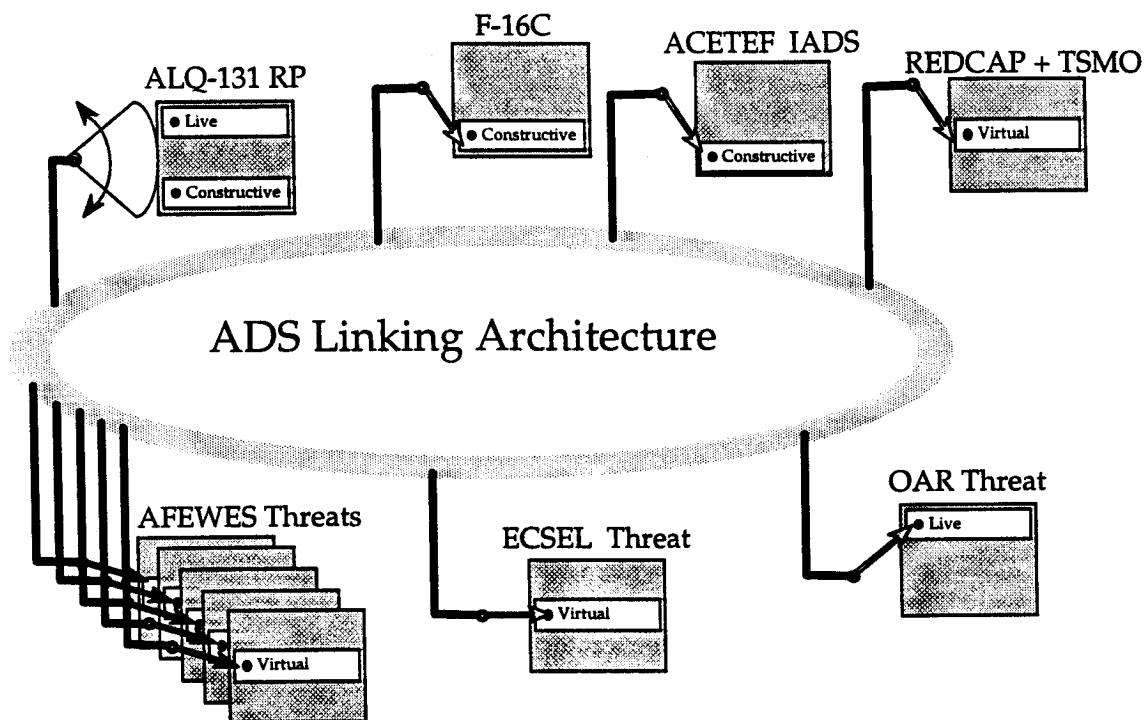
Figure 3-2 Phase I ADS Test Environment

3.4 PHASE I TEST SCENARIO

The test scenario consists of a single penetrating aircraft crossing into opposition airspace on a strike mission. The opposition target is protected by an IADS. A flight profile will be planned which requires the penetrating aircraft to engage all surface-to-air missile batteries and one anti-aircraft artillery system during ingress and egress. The figure below illustrates a possible threat laydown for the scenario.
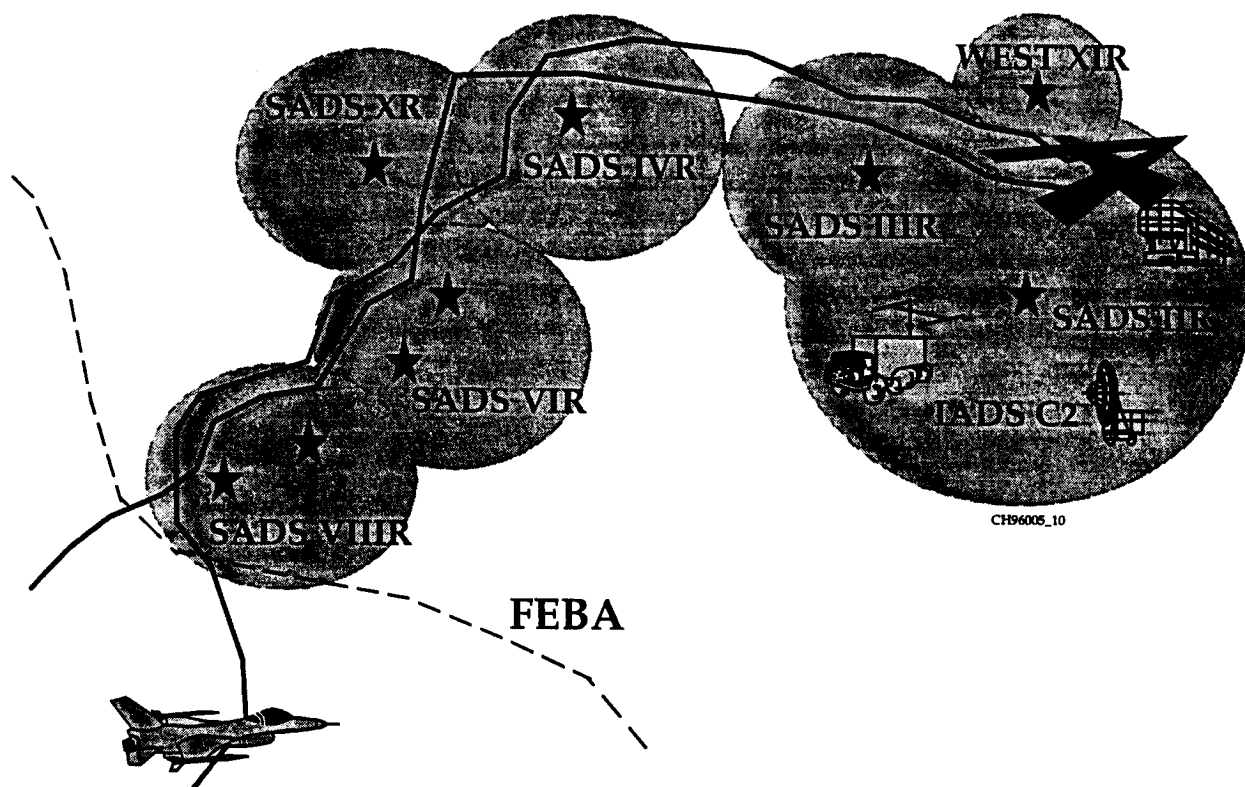
Figure 3-3 Phase I SPJ Scenario

The actual threats for the test will be a mixture of command-guided and semi-active surface-to-air missiles and one anti-aircraft artillery system based on the capabilities of the selected OAR and the HITL threat facility. Our initial analysis has identified simulated air defense systems (SADS) of the Soviet-built SA-2, SA-3, SA-4, SA-6, SA-8, SA-10, and ZSU-23-4 (West XIR) for the threat laydown. The OAR threat will include target, ECM, and clutter injection capability as part of the ADS configuration. Our initial analyses have identified simulations of the Soviet-built SA-4 or SA-8 as potential candidates for this threat.

3.4.1 Phase I Test Description : DT&E Using ADS

The following sections describe each of the four detailed tests comprising the first phase of the JADS EW T&E.

3.4.1.1 Test 1: Validation T&E

Test 1 will consist of a series of runs on an open air range against this threat laydown. Since the focus of the test is DT&E, the aircraft will fly a scripted scenario across the simulated forward edge of the battle area and have engagements with the various threats. Our initial analysis

indicates the need to fly multiple flight profiles to collect an adequate mix of performance data. The profiles will be repeated on multiple days. An objective of the test is to make the flight profiles representative of operational tactics in a simulated dense threat environment. We expect the flight profiles to provide considerable opportunity for threat engagement and expect to derive a range of results from successful engagements to simulated kills. We are currently evaluating the need to reprogram the "red" tape of the SPJ to select a non-typical response to simulate its operation in a denser threat environment than can be provided on the open air range. This would select a countermeasure typical of a one on many engagement rather than a one on one engagement. We are also evaluating the need to perform maneuvers which are representative of known failure modes to determine the ability of the test configuration to predict failure modes and support failure mode analysis.

3.4.1.2 Test 2: DSM T&E

Test 2 will conduct identical tests and profiles in an ADS environment. The block diagram below identifies the range of facilities and the exchanges between the facilities.
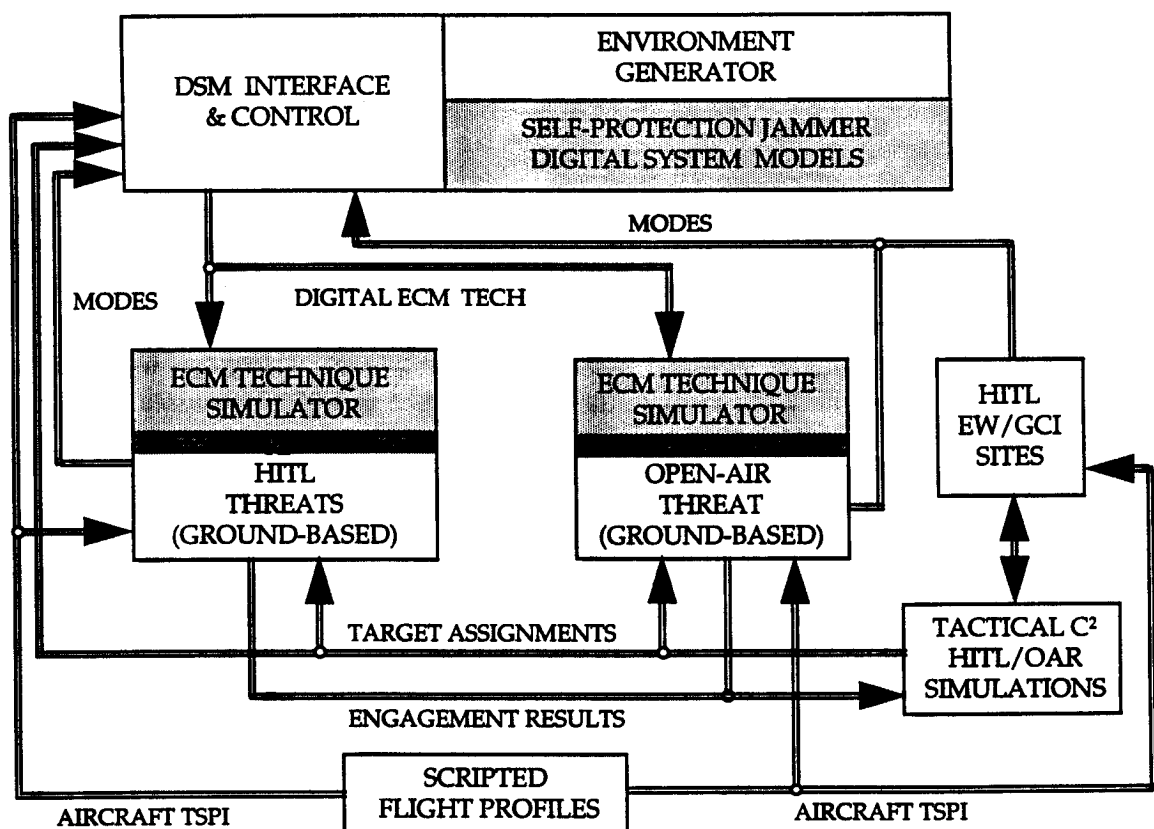

Figure 3-4 Block Diagram of the Digital System Model Test

Each of the blocks on the diagram represent a potential facility in the linked environment and the lines between the blocks are logical connections on digital communications links between the facilities. A key finding of our initial analysis was that to test a SPJ using ADS required the tester to make one of two choices. The HLA engineering prototype federation has selected the choice of replicating the entire SPJ in each threat facility either as a digital model or as actual hardware. Ownership of the aircraft and SPJ will be transferred from the aircraft/system under test facility to the threat facility at missile launch to conduct actual simulations of the missile flyout and determination of engagement results based on missile miss distance. This choice has the disadvantage of requiring test assets at each threat facility. The JADS EW test proposed the choice of effectively splitting the digital and RF portions of the SPJ between the facilities. The upper box in the diagram represents the digital portion of the jammer using the DSM under test. ECM techniques selected by the jammer will be transmitted to the HITL facility as digital words and be simulated in RF using the ECM technique simulator. The mode generated by the threat radar in response to the ECM technique will be captured digitally and transmitted back to the facility containing the SUT. This choice has the advantage of only requiring a single SUT and allows for high fidelity testing of a digital model of a conceptual system prior to hardware development. This choice does require instrumentation to verify that the transmitted modes and techniques are identical to the radiated signals in the HITL facility. We are currently planning to run the DSM and the aircraft scenario from the JADS Test Control and Analysis Center (TCAC) at Kirtland AFB, NM.

3.4.1.3 Test 3: HITL T&E

Test 3 uses ADS to link the HITL threats used in test 2 with a hardware prototype of the EW SUT. This test also includes a co-located threat in the HITL with the SUT. The diagram below identifies the range of facilities and the exchanges between the facilities. This configuration has the advantage of only requiring a single system under test and allows for high fidelity testing of a brassboard model of a conceptual system on a EW "hot bench" prior to full hardware development. It will require the same instrumentation to verify that the transmitted modes and techniques used in test 2.
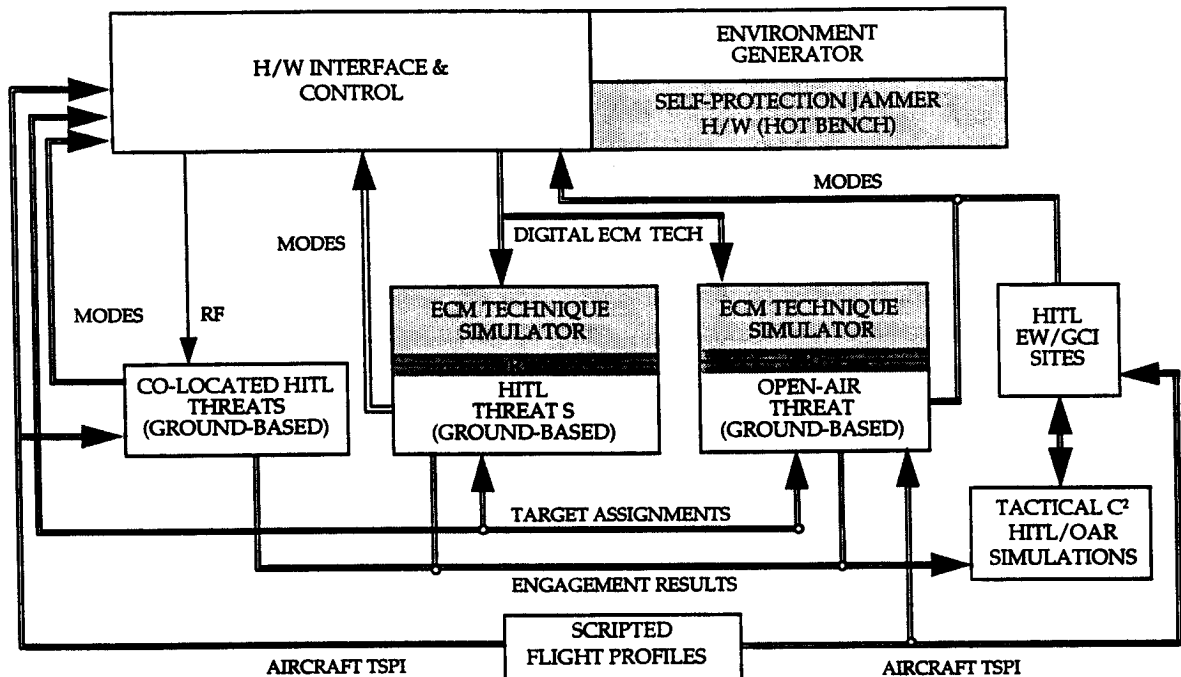
Figure 3-5 Block Diagram of the HITL Test

3.4.1.4 Test 4: ISTF T&E

Test 4 will replace the digital system model SUT with an actual SPJ SUT installed on a live aircraft in an ISTF. The block diagram below shows this configuration. The Navy's Air Combat Electronic Test and Evaluation Facility (ACETEF) is our initial selection as the ISTF for this test.
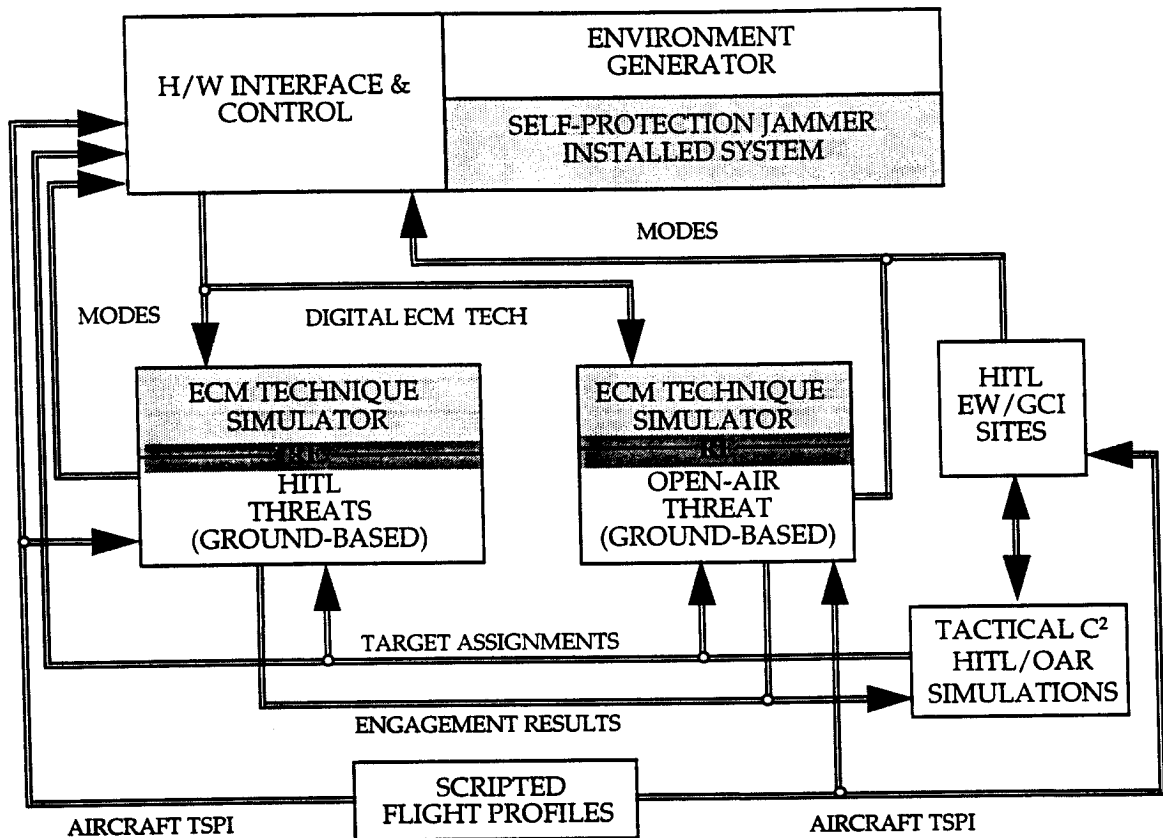
Figure 3-6 Block Diagram of Installed System Test Facility Configuration

3.4.2 ADS Test Execution

The actual execution of Tests 2, 3, and 4 is better illustrated in the following figure.
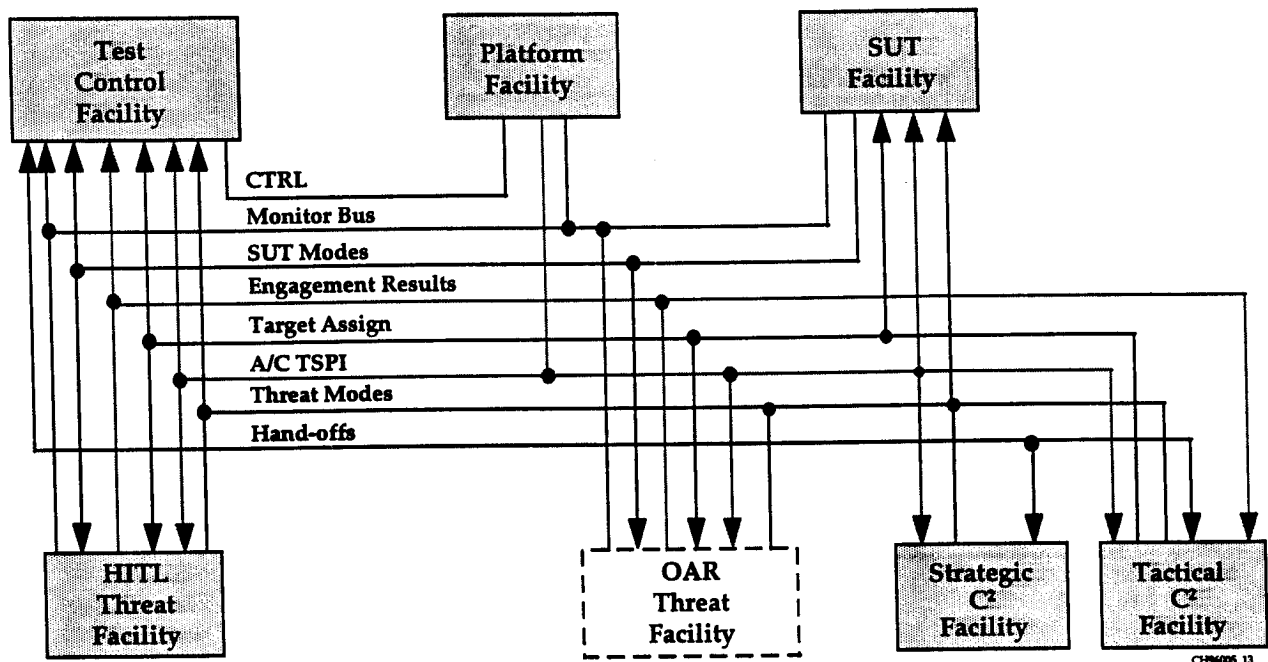
Figure 3-7 SPJ Test Facility Interactions

Once the test control facility ensures all players are ready to run the test, the control signal will be transmitted to the platform (aircraft) facility to begin to transmit TSPI data according to the scripted profile for the current test run. This information is broadcast to all the facilities. When the aircraft is within range of the early warning radar represented in the strategic C2 facility, that facility will begin to transmit appropriate signals representing the modes of the early warning radar and the intercept radars. At the appropriate time in the scenario, the strategic C2 facility will hand off responsibility for the target to the tactical C2 facility who will assign the target to one of the terminal threats in the HITL facility. Once track mode has been initiated, an engagement will ensue with exchanges of threat modes and ECM techniques with a potential missile launch and flyout. Engagement results are reported back through the C2 facilities. The scenario will continue to run with engagements between the aircraft SPJ system and each of the threat systems encountered while flying to and from the target. Notice that if an OAR threat is included in the scenario, the message interchange is identical to that of HITL threats. Each of the flight profiles in test 1 on the OAR will be replicated in the ADS environments during the DSM, HITL, and the installed system tests.

3.5 PHASE II: EW MISSION LEVEL T&E METHODOLOGY

The purpose of the mission level test is to determine the utility of ADS technology in an OT&E context. Having validated the application of ADS in the DT&E context the same ADS assets plus additional assets for air-to-air encounter assessment will be used to perform an OT&E.

The scenario will consist of OAR, HITL, and M&S representations of an IADS threat environment. These threats will be integrated into an operational scenario using ADS. The concept is shown in Figure 3-8 and includes the additions over the DT&E environment of enemy AI and AWACS and friendly flight aircraft and AWACS. All of the capabilities of the DT&E test capabilities are exploited in greater numbers of players and M&S is used to further augment the scenario creation capability.
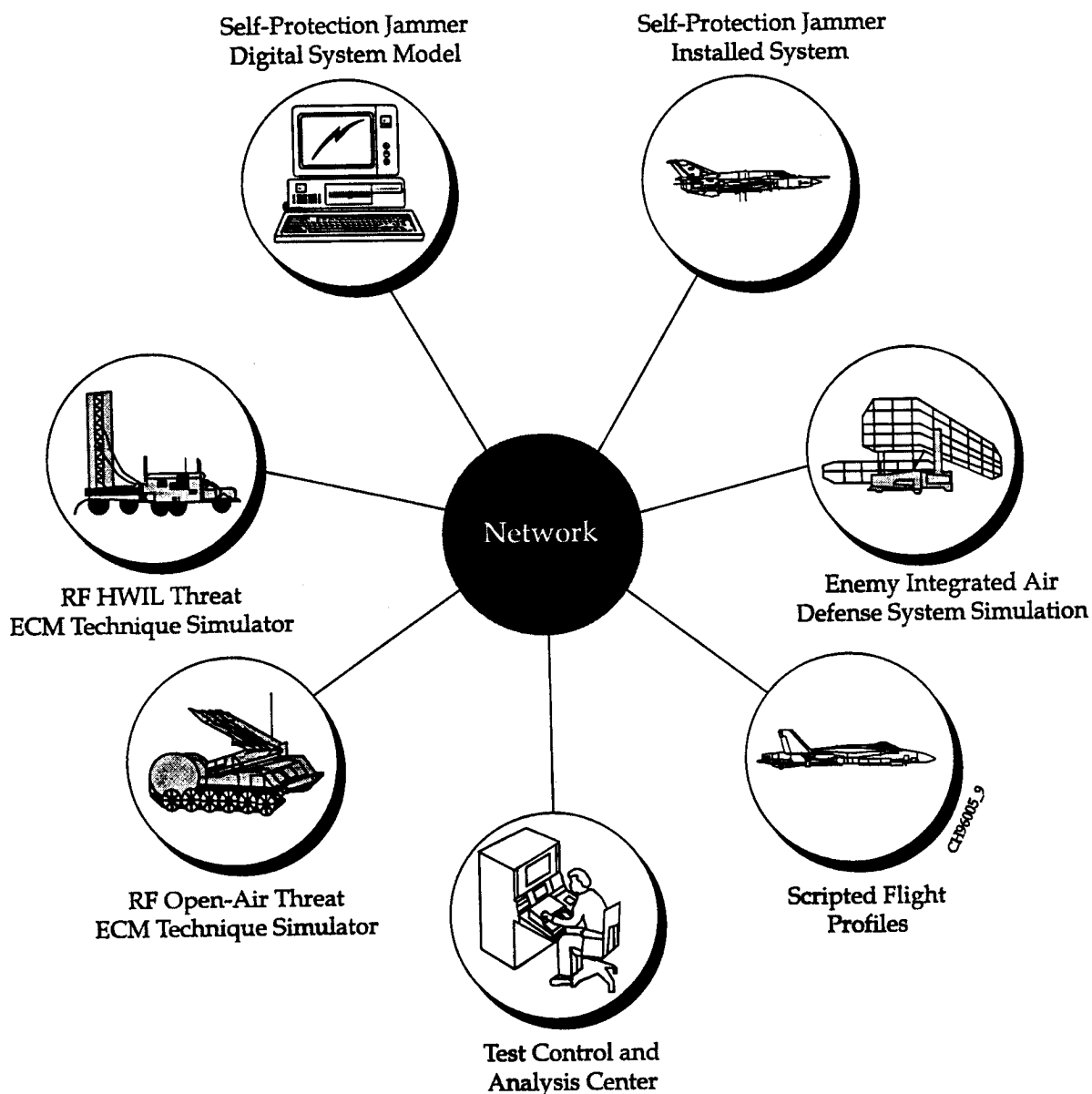

Figure 3-8 Mission Level ADS T&E Environment

The mission level test will consists of an F/A-18 protected by a towed decoy represented by a DSM. Additional aircraft, both friendly and enemy, are represented by man-in-the-loop (MITL) flight simulator stations. The flight simulator stations will provide capability for evaluation of air-to-air combat as an excursion in a battlefield interdiction mission. Multi-spectral threats will be represented in HITL facilities.

3.6 PHASE II: TEST ENVIRONMENT

The model for the mission level test environment is the IRAQI 2010 threat scenario laydown. The modern EW environment consists of RF and IR and electro-optical (EO) threats and countermeasures. In the mission level test the RF and IR threats will be included. The countermeasures will include RF self-protection, RF stand-off, and IR self-protection. The flight of penetrating aircraft will be escorted and covered by an additional flight of aircraft. Both friendly and enemy AWACS will be included. In the mission level test the SUT will be a DSM representation of a multi-spectral SPJ. The SUT will consist of the aircraft platform (RF and IR signatures) and a SPJ. A scripted flight profile will be used for all aircraft except the man-in-the-loop flight simulator stations, which will dynamically control their own flight profiles. A pictorial of the scenario is shown in Figure 3-9.
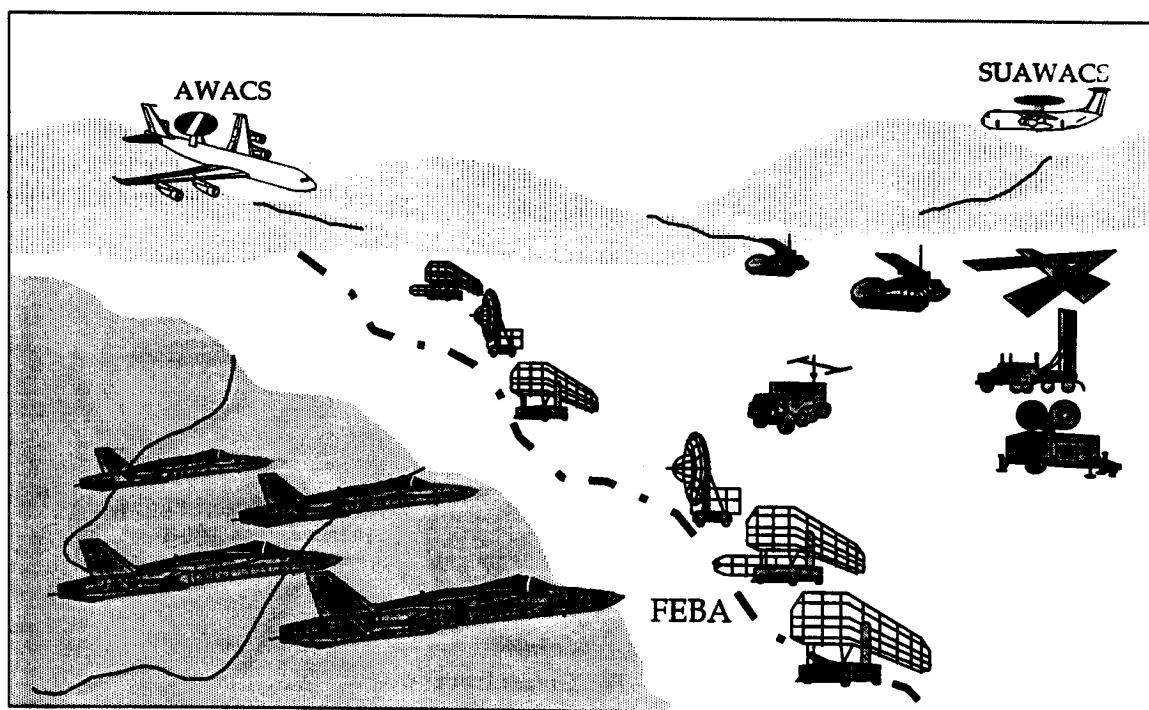

Figure 3-9 Phase II SPJ Scenario

3.7 PHASE II: TEST ARTICLES

3.7.1 EW SUT and Host Aircraft

The SUT will be a DSM representation of the Advanced Airborne Expendable Decoy (AAED) towed decoy. This system is expected to provide multi-spectral self-protection. Support jamming of the EW/GCI network of threat radars will be provided as representative of the EF-111. The first priority is the F/A-18 with the AAED towed decoy, ALQ-126B, ALR-67, a chaff and flare dispenser, and a missile warning system. The second priority is the F-16 with the ALQ-131R/P, ALE-47 chaff and flare dispenser, ALR-56M, and a missile warning system.

3.7.2 Strike/Support Force

The host aircraft will be the F/A-18 (first choice) or the F-16. Four aircraft will make up the strike package and four aircraft will constitute the escort/cover aircraft. The same self-protection suite will be employed on all penetrating aircraft. The lead aircraft and wingman will be represented by flight simulator stations at the AFEWES and/or ACETEF. The other two aircraft will be represented by DSM with scripted flight profiles. A stand-off jammer (i.e. EF-111) will be provided by REDCAP with appropriate signal injection into the C2 network.

3.7.3 Red IADS

The ground command and control system is represented with OAR assets provided by TSMO for tactical C2 and with HITL assets provided by REDCAP for strategic C2. REDCAP will provide DSM capabilities for C2 sites to fill out the C2 structure.

3.7.4 Red Air Picture

The enemy airborne interceptors will be provided by flight simulator stations at either AFEWES or REDCAP. The enemy air picture will be provided by REDCAP using a HITL facility representation of the enemy AWACS function. This enemy AWACS function will be integrated into the strategic C2 network as appropriate.

3.7.5 EW Terminal Threats

The terminal threats will be handled in the same fashion as the DT&E tests. All of the assets available will be employed including those of AFEWES, ECSEL, linked OAR threats, and ACETEF HITL threats.

3.7.6 Blue Air Picture and Blue C2

The friendly C2 and air picture will be provided by TACCSF. An AWACS system will control the penetrating aircraft and provide warning of the presents of unfriendly airborne interceptors. A backup capability will be an E-2C simulator at ACETEF.

3.7.7 Test Article Summary

A summary of the test articles is shown in Figure 3-10. The figure illustrates the DSM SUT, REDCAP strategic C2 (HITL and DSM), TSMO tactical C2, F/A-18 aircraft, towed decoy and ECM suite, terminal threats (AFEWES, ECSEL, ACETEF), and friendly C2 at TACCSF.
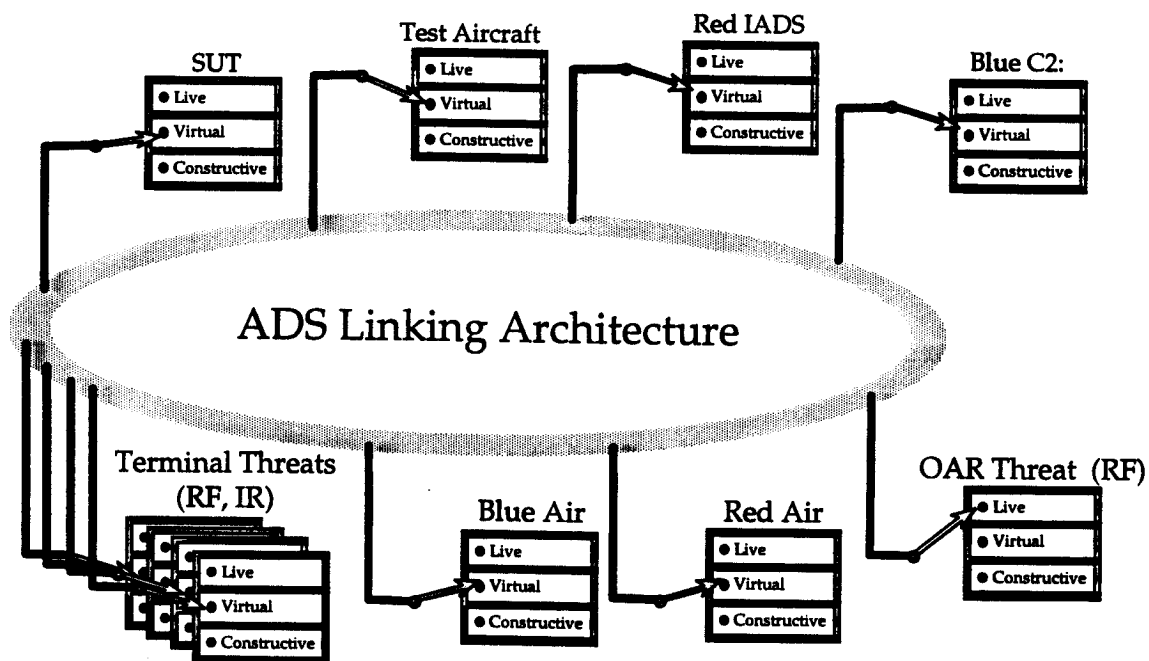

Figure 3-10 Phase II ADS Test Environment

3.8 PHASE II TEST SCENARIOS

3.8.1 Test Description for Mission Level T&E using ADS

The use of ADS for the mission level T&E is the same as the DSM DT&E test. The only differences are that additional assets will be employed, such as friendly C2, friendly support aircraft, and enemy airborne interceptors. The block diagram for the operational test is shown in Figure 3-11.

Figure 3-11 Block Diagram of the Phase 2 Operational Test

3.8.2 ADS Test Execution

The execution of the test in the ADS environment is as in the DSM DT&E test. The network diagram showing test facility interactions is shown in Figure 3-12. This figure shows the additional assets used in the operational test.
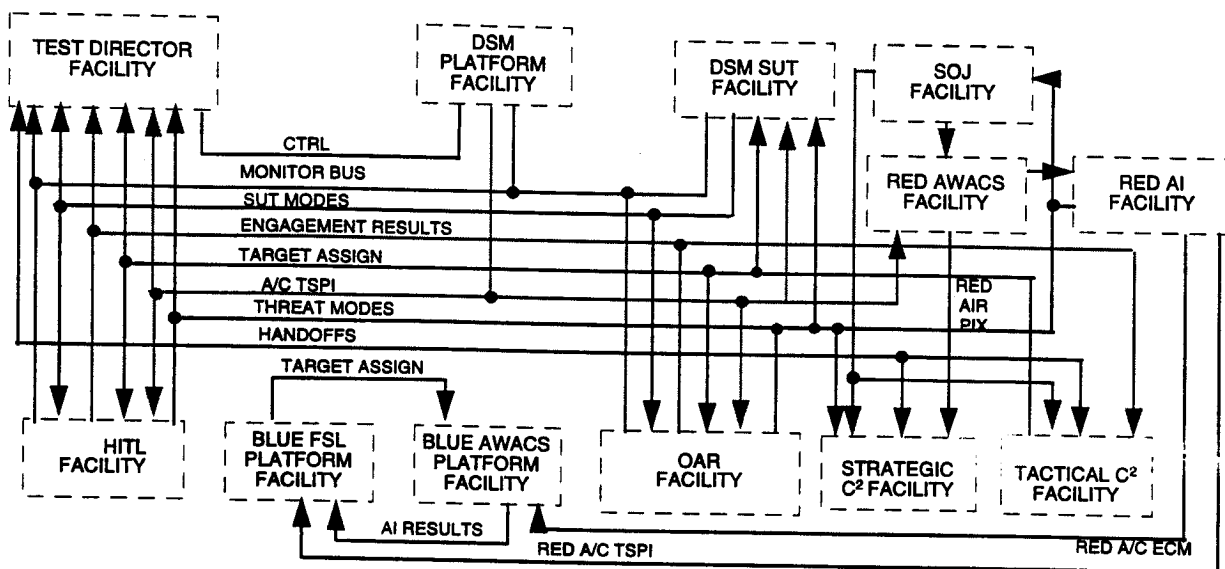
Figure 3-12 Mission Level Test Facility Interaction

3.9 APPROACHES FOR RESOLVING EW TEST AND TECHNOLOGY ISSUES

As discussed in previous sections, the general approach to assessing the utility of ADS for EW T&E is based on identifying ADS supported test environments and scenarios which have potential utility to the existing EW test process. Real answers will be gained only by testing the feasibility and performance of these environments and scenarios. JADS designed a two-phased test and specific SPJ representations for the ADS tests to address the specific issues listed below and discussed in the following paragraphs:

- Inherent Limitations of the EW Test Process
    - Correlation of test results between facilities and phases
    - Resource limitations at test facilities
    - Fidelity limitations at threat facilities
- Development of high fidelity real-time digital models of the SPJ
- Inability of current networking technology to support pulse-to-pulse interactions
- Instrumentation requirements for ADS tests
- ADS-induced errors in test results
- Conduct of closed-loop effectiveness testing on an installed system
- Evaluation of potential enhancements to the EW test process early in development
    - Early identification and tracking of key performance issues

- Early identification and testing of failure modes
- Realistic "test before you build" capability
- Early start on mission software development and test
- Early planning and rehearsal of DT&E and OT&E
- Early effectiveness testing in System Integration Labs
- Evaluation of potential enhancements to the EW test process late in development
  - Closed-loop effectiveness testing of an installed system
  - Flight test rehearsal capability

3.9.1 Inherent Limitations in the EW Test Process

In Section 2.1.2, several inherent limitations to the current EW test process were identified. The first of these was the ability to correlate test results between test facilities and throughout testing during development of the system. ADS provides an approach to solving this limitation through a combination of common test environments and the application of test discipline throughout the entire system development process. A system developer will be able to select, using operational requirements for the system, reference test conditions (RTC) early in the development cycle of the system and apply these conditions consistently across a common test environment throughout the development of the system. The SPJ test represents each of the phases of the EW test process. The representations of the SPJ will be tested under the same RTC using a common test environment. Successful correlation of the JADS test results across the phases will verify this ADS solution to the limitation.

The second limitation to the current process was identified as resource limitations in EW testing. ADS provides several opportunities to address these limitations. From the standpoint of the threat environment, ADS provides the capability to expand the numbers of threats and the depth of the command and control network for the SUT beyond the capabilities of a single facility. A successful SPJ test in the proposed ADS environment will provide this capability earlier in the process at a higher level of fidelity. Another resource limitation is in the number of test articles available for testing and the inability to test systems at low levels of maturity in a high-fidelity environment. The SPJ test evaluates the ability to link a single SUT to multiple threats at any level of system maturity. Another resource limitation is related to physical limitations of the open air test ranges. The ADS solution to this test constraint is to augment OAR with threats at other facilities and effectively expand the range. Current technical limitations on the use of live aircraft in the ADS environment limit the ability to address this issue on the OAR; however, the expanded capability offered by closed-loop testing using a linked ISTF will allow an expanded synthetic range in which to test the installed system.

The ADS approach to addressing fidelity limitations is the ability to link the SUT to threat simulations at other facilities which provide higher fidelity testing than available at the developer's primary test facility. Currently, this capability is achieved by sequential testing at multiple facilities. Sequential testing is limited by both correlation problems and test resources. A common linked test environment would provide a solution to these problems by allowing connection to assets at multiple facilities from a single location and access to higher fidelity test assets earlier in the test process.

3.9.2 Development of High-Fidelity Real-Time Digital Models

The EW test process identifies the need for high-fidelity models of the EW systems being developed. Ideally, these models will operate in real time. Although models of systems have been developed, they have not operated in real time and, therefore, cannot be used with real-time test assets. The approach adopted by the JADS EW team will provide a validation of the ability to develop such models and an approach for high-fidelity testing using such models.

3.9.3 Current Networking Limitations

Most analyses of the application of ADS technology to EW T&E have suggested an inability of current networking and ADS technology to support the pulse-to-pulse interactions in RF required of EW engagements. The approach adopted by the JADS test removes the need for networked RF engagements and eliminates the pulse-to-pulse transmission requirements. This approach does present challenges relating to signal representation and the timing and synchronization of the interactions; however, these challenges appear to be solvable within the current state of the art. The SPJ tests will verify the ability to overcome these issues, provide testers with acceptable levels of fidelity, and actually use ADS to test EW systems.

3.9.4 Instrumentation Requirements for EW Tests Using ADS

Another concern of some EW testers is the requirement for verification that simulated RF signals actually match the technique or mode selected by the threat emitter or jammer in a test facility. The JADS approach to signal representation places more emphasis on this requirement. The JADS EW team has only identified two facilities, Preflight Integration of Munitions and Electronics Systems (PRIMES) and Electromagnetic Test Environment (EMTE) at Eglin AFB, FL, with the real-time verification instrumentation for emitters and jammers. The SPJ test will acquire and install the appropriate instrumentation in each of the selected test facilities and evaluate the value of the instrumentation for the test.

3.9.5 ADS-Induced Errors in Test Results

A key issue related to T&E in an ADS environment is the potential impact of the ADS environment on the test results. The JADS EW approach to testing first in a common non-ADS (e.g., OAR) and ADS environments(DSM, HITL, and ISTF) and then performing rigorous correlation analysis on the test results will provide a clear measure of the validity of the test results and will identify the specific performance measures which may have been impacted by the ADS environment. Detailed collection and analysis of network performance data in conjunction with the identification of potential invalid performance measures will allow for rigorous evaluation of cause and effect.

3.9.6 Closed-loop Effectiveness Testing on an Installed System

Another technical challenge for the proposed test concept is the integration of the ADS test environment with an ISTF to conduct closed-loop effectiveness of the SPJ installed on the actual aircraft. Currently, the primary ISTFs conduct open-loop testing of the operation of the system and electromagnetic interference and compatibility (EMI/EMC) testing of the systems in these facilities. This approach will represent a significant improvement to the capabilities of these facilities which is crucial to the full realization of the potential of ADS.

3.9.7 Potential Enhancements Using ADS Early in Development

Application of the ADS technology represented in the Phase I SPJ tests 2 and 3 holds considerable promise to enhance the current EW development and test process. The ability to perform high-fidelity DSM testing of conceptual systems has the potential to provide a realistic "test before you build" capability to EW system developments. The requirements of the conceptual system can be identified and evaluated in a high-fidelity test environment and key performance issues can be identified early in the development for special emphasis. Through the conduct of effectiveness testing of these conceptual systems in a more operationally representative environment, the developer will be able to identify failure modes of the system and provide solutions early in the development process where modification costs are lower. Another potential advantage provided by the ability to develop and test a real-time digital model of the developing system is the potential ability to begin the mission software development and test earlier, thus reducing program development risk. The application of ADS provides higher-fidelity testing in a SIL of an EW "brassboard" SUT configuration, provides a more operationally representative environment earlier in hardware testing, and allows identification and evaluation of failure modes while avoiding duplicating SIL assets at HITL facilities. Finally, this capability offers advantages in the planning and rehearsal of both DT&E and OT&E. The Phase I SPJ test will provide insights into these potential enhancements of the EW test process.

3.9.8 Potential Enhancements Using ADS Late in Development

The last test in Phase I (test 4) in the ISTF represents the later developmental stages of the SPJ in EW test process. This test has the potential for enhancement of actual EW system assets installed on the target aircraft. The ability to perform closed-loop effectiveness testing in an ISTF will provide a much better predictor of the performance of the system while capturing the effects of aircraft integration and EMI/EMC on system performance.

The Phase II mission level test is an expansion of the initial program's T&E environment to include integration of a domed simulator allowing flight test rehearsal, high-fidelity testing against threats and threat laydowns which are not supported by the test ranges, and the ability to improve flight testing at those critical "edge of the envelope" tests. The JADS SPJ Phase II test will provide insights into ADS capabilities to provide testers with a Cost and Operational Effectiveness Analysis (COEA) level analysis capability with T&E fidelity for determining top level measures, to include probability of survival and mission effectiveness.

3.10 SUMMARY

This discussion has provided the details of the JADS EW SPJ test concept and the technical issues addressed by the test. The next section will provide the detailed test objectives and measures of each activity, and describe the data collection and analysis required to meet these objectives.